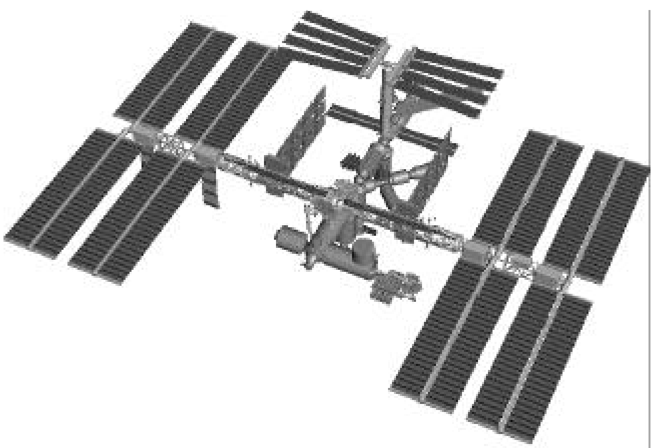
NASA Facts

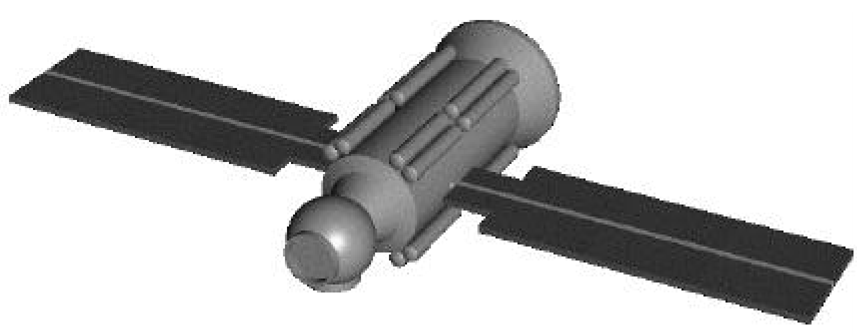
National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

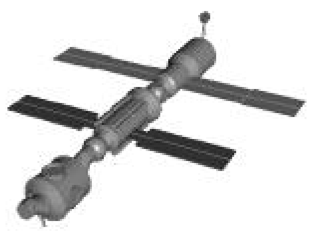
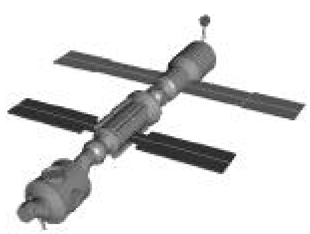
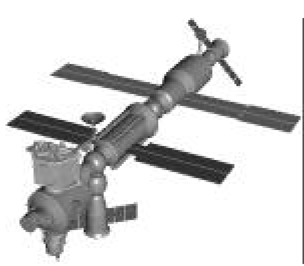
International Space Station **June 1998**

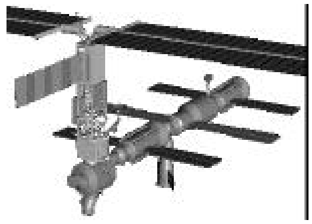
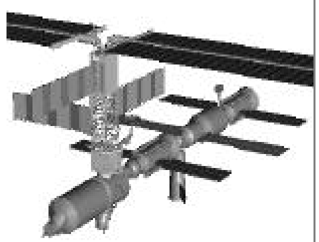
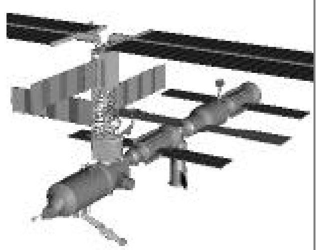
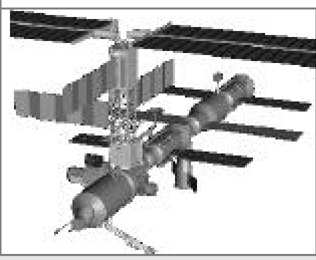
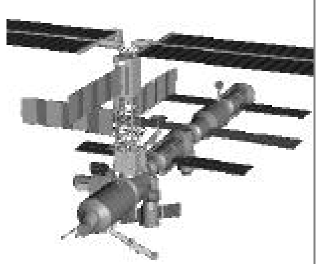
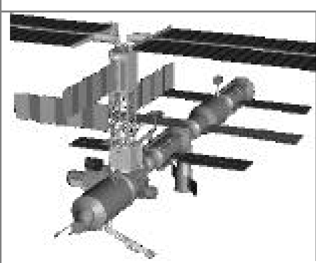
INTERNATIONAL SPACE STATION ASSEMBLY SEQUENCE (5/31/98: Revision D)

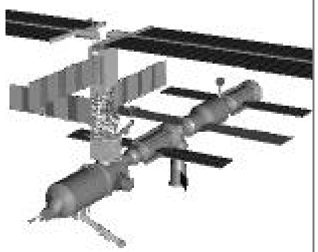
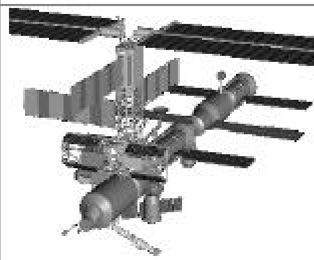
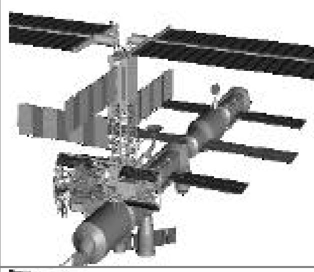
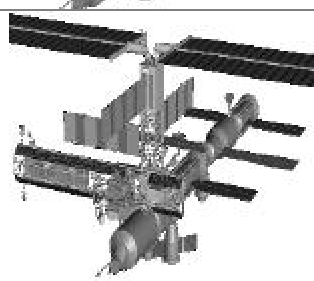
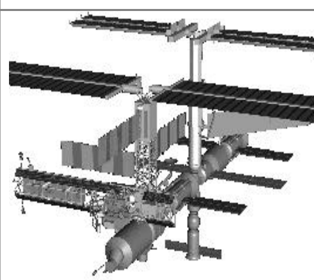
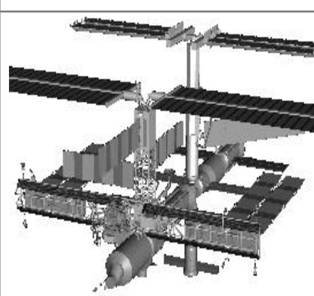


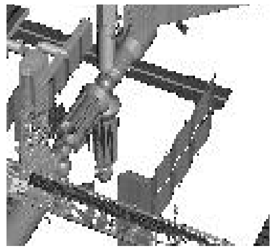
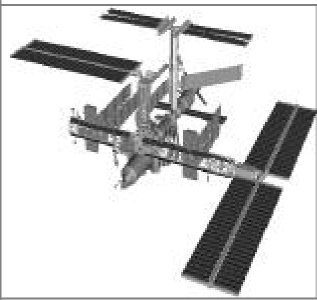
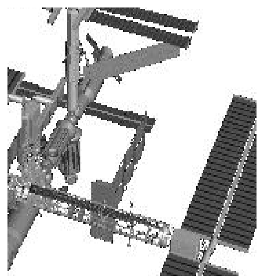
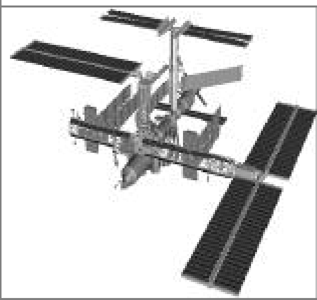
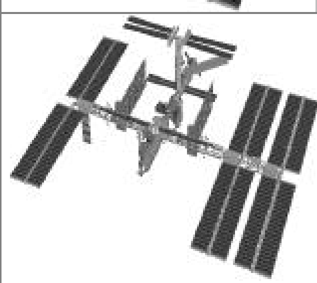
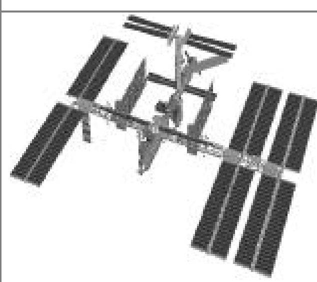


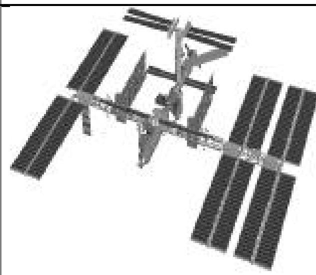
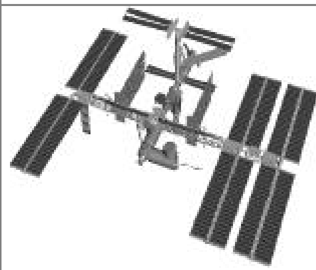
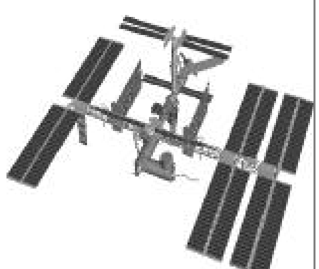
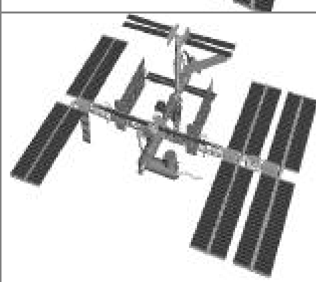
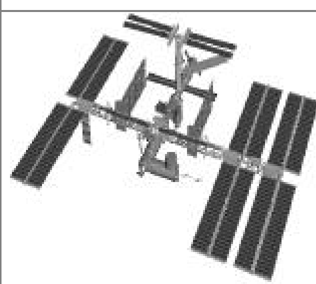
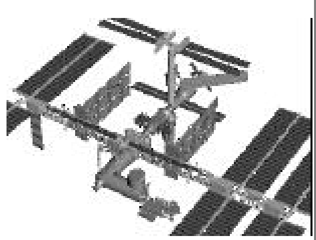
Note: Some issues in this assembly sequence remain under review and will be resolved at a Space Station Control Board meeting in September 1998. Missions with open issues are noted in italics.

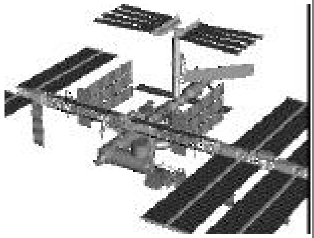
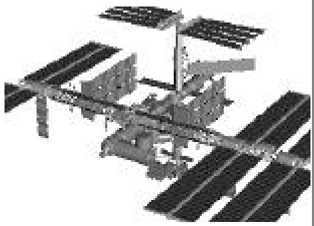
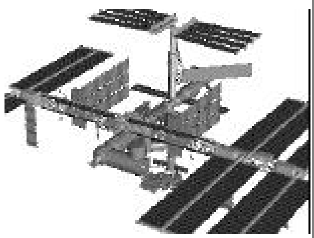
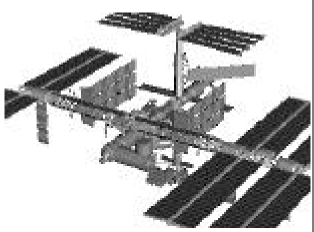
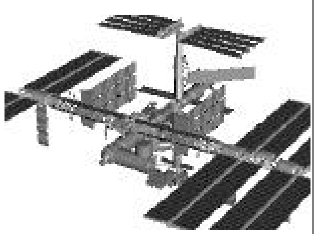
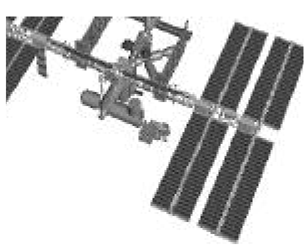
Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Nov 1998	1A/R	Russian Proton Rocket		• Control Module (Functional Cargo Block-FGB)	• The Control Module (FGB) is a self-supporting active vehicle. • It provides propulsive control capability and power through the early assembly stages. • It provides fuel storage capability. • It provides a rendezvous and docking capability to the Service Module.
Dec 1998	2A	US Space Shuttle (STS-88)		• Unity node • 2 Pressurized Mating Adapters attached to Unity	• Unity is launched passive with 2 Pressurized Mating Adapters (PMAs) attached and 1 stowage rack installed inside. • PMA-1 will connect US and Russian elements. PMA-2 provides a Shuttle docking location. • Eventually, Unity's six ports will provide connecting points for the Z1 truss exterior framework; U.S. lab; airlock; cupola; Node 3; and the MPLM as well as the Control Module.
Apr 1999	1R	Russian Proton Rocket		• Service Module	• The Service Module is the primary Russian station contribution and an early station living quarters. It provides life support system functions to all early elements. • Primary docking port for Progress-type cargo resupply vehicles. • Provides propulsive attitude control and reboost capability for early station.
May 1999	2A.1	US Space Shuttle (STS-96)		• Spacehab Double Cargo Module	• Carries internal logistics and resupply cargo for station outfitting. • Carries external Russian cargo crane to be mounted to exterior of Russian station segment and used to perform spacewalking maintenance activities.
June 1999	3A	US Space Shuttle (STS-92)		• Integrated Truss Structure (ITS) Z1 • PMA-3 • Ku-band communications system • Control Moment Gyros (CMGs)	• ITS Z1 is an early exterior framework to allow first U.S. solar arrays on flight 4A to be temporarily installed on Unity for early power. • Ku-band communication system supports early science capability and U.S. television on 6A. • CMGs provide non-propulsive (electrically powered) attitude control when activated on 5A. • PMA-3 provides Shuttle docking port for solar array installation on 4A, Lab installation on 5A.
July 1999	2R	Russian Soyuz Rocket		• Soyuz	• Establishes first station manning with three-person crew: Commnader Bill Shepherd; Soyuz Commander Yuri Gidzenko; Flight Engineer Sergei Krikalev. • Provides Russian assured crew return capability without the Space Shuttle present. • Station begins permanent human presence.

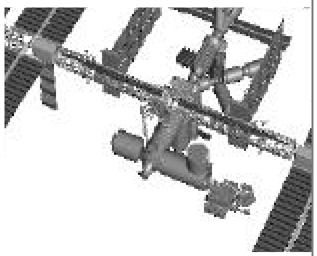
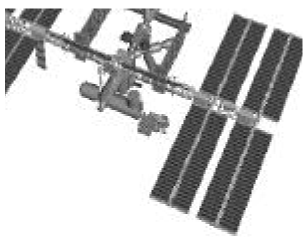
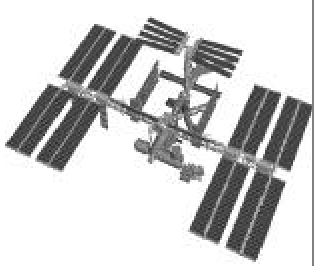
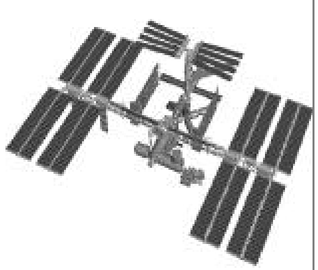
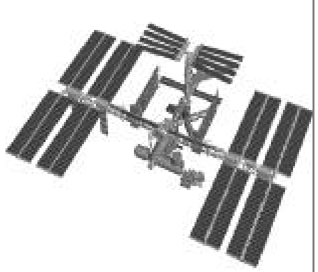
Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Aug 1999	4A	US Space Shuttle (STS-97)		• Integrated Truss Structure P6 • Photovoltaic Module • Radiators	• Provides first US solar power with solar arrays and batteries, called photovoltaic (PV) module. • First PV module installed temporarily on Z1 truss until after 13A when can be moved to P5 truss. • Two radiators provide early cooling, called photovoltaic (PV) Thermal Control System (TCS) radiators. Also, S-band communications system is activated for voice and telemetry.
Oct 1999	5A	US Space Shuttle (STS-98)		• U.S. Laboratory Module	• Provides initial US user capability. • Launched with 5 system racks already installed inside of the module. • Control Moment Gyroscopes are activated with delivery of electronics in lab, providing electrically powered attitude control.
Dec 1999	6A	US Space Shuttle (STS-99)		• MPLM (U.S. Lab outfitting) • Ultra High Frequency (UHF) antenna • Space Station Remote Manipulator System	• Italian-built Multi-Purpose Logistics Module (MPLM) carries 6 system racks and 2 storage racks to be installed in U.S. Lab. • UHF antenna provides space-to-space communications capability for US-based spacewalks. • Delivers Canadian SSRMS (station mechanical arm) needed to perform assembly operations on later flights.
Jan 2000	7A	US Space Shuttle (STS-100)		• Joint Airlock • High Pressure Gas Assembly	• Airlock provides station-based Extravehicular Activity (EVA) spacewalking capability for both US and Russian spacesuits. • High pressure gas assembly supports spacewalk operations and augments the Service Module gas resupply system.
			Phase II Complete		
Mar 2000	4R	Russian Soyuz Rocket		• Docking Compartment Module-1 (DCM-1)	• Provides additional egress, ingress location for Russian-based spacewalks and a Soyuz docking port.
Mar 2000 *some flight details still under review*	*7A.1*	*US Space Shuttle (STS-102)*		• *MPLM*	• *U.S. stowage racks and International Standard Payload Racks (ISPRs) carried in MPLM.*

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Apr 2000	UF-1	US Space Shuttle (STS-104)		• MPLM • PV Module batteries • Spares Pallet (spares warehouse)	• Provides for research work by delivering experiment racks for US Laboratory and two storage racks. • Spares Pallet provides an exterior "warehouse" for spare station parts. Attached to the exterior of the station airlock, it will house spare replacement equipment for station maintenance in a location convenient to spacewalking astronauts..
Jun 2000	8A	US Space Shuttle (STS-105)		• Central truss segment (ITS S0) • Mobile Transporter (MT)	• Integrated Truss Structure S0 is center segment of the 300-foot station truss, attached to the U.S. Lab. By assembly complete, four more truss segments will attach to either side of the S0 truss. • Provided by Canada, the Mobile Transporter creates a movable base for the station's Canadian mechanical arm, allowing it to travel along the station truss after delivery of the Mobile Base
Aug 2000	UF-2	US Space Shuttle (STS-106)		• MPLM with payload racks • Mobile Base System (MBS)	• The Multi-Purpose Logistics Module (MPLM) carries experiment racks and three stowage and resupply racks to the station. • The Mobile Base System is installed on the Mobile Transporter to complete the Canadian Mobile Servicing System (MSS). The mechanical arm will now have the capability to "inchworm" from the U.S. lab fixture to the MSS and travel along the truss to work sites.
Oct 2000	9A	US Space Shuttle (STS-108)		• First starboard truss segment (ITS S1) with radiators • Crew and Equipment Translation Aid (CETA) Cart A	• Delivers first starboard truss segment (S1 truss) to be attached to central truss segment (S0 truss). Additional cooling radiators are delivered but will remain stowed until flight 12A.1. • Backup S-band communications capability is provided. • CETA cart can be used by spacewalkers to move along truss with equipment.
Jan 2001	9A.1	US Space Shuttle (STS-109)		• Russian-provided Science Power Platform (SPP) with four solar arrays	• Delivery of the Russian power and control mast with four solar arrays, called the Science Power Platform, will provide additional Russian electrical power. • Delivers European Robotic Arm (ERA), a second station mechanical arm that will be used to maintain the SPP.
Feb 2001	11A	US Space Shuttle (STS-110)		• First port truss segment (ITS P1) • Crew and Equipment Translation Aid (CETA) Cart B	• Delivers the first port truss segment (P1 truss) to be attached to central truss segment (S0 truss). Also includes additional cooling radiators that will remain stowed until flight 12A.1. • The Crew and Equipment Translation Aid Cart can be used by spacewalkers to move along the truss with equipment.

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
April 2001 *some flight details still under review*	*3R*	*Russian Proton Rocket*		• *Universal Docking Module*	• *Provides docking locations for Russian Research Modules and a Docking Compartment (DC2) delivered on Flight 5R. The module also provides additional life support systems capabilities.*
May 2001	12A	US Space Shuttle (STS-111)		• Second port truss segment (ITS P3/P4) • Solar array and batteries	• Delivers second port truss segment (P3/P4 truss) to attach to first port truss segment (P1 truss). • Central cooling radiators, delivered earlier on flights 9A and 11A, are deployed from first starboard (S1 truss) port (P1) truss segments. • Exterior attachments for Brazilian Unpressurized Logistics Carriers (ULCs) are delivered.
May 2001 *some flight details still under review*	*5R*	*Russian Soyuz Rocket*		• *Docking Compartment 2 (DC2)*	• *Provides an improved Russian airlock.*
June 2001	12A.1	US Space Shuttle (STS-112)		• Third port truss segment (ITS P5) • Multi-Purpose Logistics Module	• Delivers third port truss segment (P5 truss) to attach to second port truss segment (P3/P4 truss).
June 2001	13A	US Space Shuttle (STS-113)		• Second starboard truss segment (ITS S3/S4) • Solar array set and batteries (Photovoltaic Module)	• The second starboard truss segment (S3/S4 truss) is attached along with a third set of solar arrays. • Four external attachment sites for truss-mounted exterior experiments and research are delivered.
Sep 2001	10A	US Space Shuttle (STS-114)		• Node 2	• The second of three station connecting modules, Node 2, attaches to end of U.S. Lab and provides attach locations for the Japanese laboratory, European laboratory, the Centrifuge Accomodation Module and later Multi-Purpose Logistics Modules • Primary docking location for the Shuttle will be a pressurized mating adapter attached to Node 2.

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Oct 2001 *some flight details still under review*	*1J/A*	*US Space Shuttle (STS-115)*		• *Japanese Experiment Module Experiment Logistics Module (JEM ELM PS)* • *Science Power Platform (SPP) solar arrays*	• *Japanese-developed pressurized logistics module is delivered carrying four systems racks, 1 stowage rack and 3 experiment racks to be used for Japanese laboratory (Japanese Experiment Module) to be delivered on flight 1J.* • *Two additional solar arrys for the Russian Science Power Platform (SPP) are delivered on the Brazilian Unpressurized Logistics Carrier (ULC) in the shuttle's payload bay.*
Jan 2002	1J	US Space Shuttle (STS-116)		• Japanese Experiment Module (JEM) • Japanese Remote Manipulator System (JEM RMS)	• The primary Japanese contribution, the Japanese Experiment Module (JEM) laboratory, is delivered and begins use. • A Japanese robotic arm attached to the Japanese Experiment Module is delivered. The arm will be used to tend experiments on the laboratory's "back porch," an Exposed Facility (EF) to be delivered on flight 2 J/A.
Feb 2002	9R	Russian Proton Rocket		• Docking and Stowage Module (DSM)	• Mounted to the Control Module (FGB) nadir port. • Provides additional on-orbit stowage and Soyuz docking location.
Feb 2002	UF-3	US Space Shuttle (STS-117)		• Multi-Purpose Logistics Module (MPLM) • Express Pallet	• Provides for experiment delivery, resupply and changeout. • Multi-Purpose Logisitcs Module carries inside experiment equipment racks. • Express Pallet carries external experiment equipment.
May 2002	UF-4	US Space Shuttle (STS-118)		• Express Pallet • Spacelab Pallet carrying "Canada Hand" (Special Purpose Dexterouos Manipulator) • Alpha Magnetic Spectrometer	• Canadian-developed "hand" for station mechanical arm provides more intricate robotic maintenance capability. • Provides for experiment resupply and cha • Express Pallet carries external expeirment equipment. • Delivers Alpha Magnetic Spectrometer experiment to be attached to station truss site.
June 2002	2J/A	US Space Shuttle (STS-119)		• Japanese Experiment Module Exposed Facility (JEM EF) • Solar Array Batteries	• Delivers "back porch" (Exposed Facility) for Japanese laboratory (JEM) along with external experiments carried in a Japanese exterior logistics carrier. • Four additional battery sets are delivered to complete the complement of batteries for all U.S. solar array sets delivered thus far.

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Aug 2002	14A	US Space Shuttle (STS-120)		• Cupola • Science Power Platform (SPP) Solar Arrays • Service Module Micrometeroid and Orbital Debris Shields (SMMOD)	• Cupola with eight windows provides station crew with direct viewing capability for some robotics operations, spacewalks and experiments. • Two additional Russian Science Power Platform (SPP) Solar Arrays complete the arrays on the SPP. SPP arrays and exterior debris shielding for Service Module (SMMOD) are carried on Brazilian-provided Unpressurized Logistics Carrier (ULC).
Aug 2002	8R	Russian Soyuz Rocket		• Research Module 1	• Delivers first of two Russian laboratories providing experiment and research facilities.
Sep 2002	UF-5	US Space Shuttle (STS-121)		• Multi-Purpose Logistics Module • Express Pallet	• Provides for experiment delivery, resupply and changeout. • Multi-Purpose Logisitcs Module carries inside experiment equipment racks. • Express Pallet carries external experiment equipment.
Oct 2002	20A	US Space Shuttle (STS-122)		• Node 3	• Delivers third node as conecting module for station (Node 3) to be attached underneath Unity node (Node 1). • Inside of Node 3 are 2 avionics racks and 2 life support system racks. • Node 3 provides attachment points for the U.S. Habitation Module, U.S. Crew Return Vehicle, pressurized mating adapter, and any future station additions.
Nov 2002 *some flight detail s still under review*	*10R*	*Russian Soyuz Rocket*		• *Research Module 2*	• *Delivers a second Russian laboratory to house experiments and research facilities.*
Nov 2002 target date, flight detail s still under review	*17A*	*US Space Shuttle (STS-123)*		• *Multi-Purpose Logistics Module* • *Node 3, U.S. Lab racks*	• *Delivers racks for Node 3 that allow expansion of station crew from three members to up to six members.* • *Outfits Node 3 with racks carried in MPLM: 2 life support system racks; 2 flight crew equipment racks (waste collection system and galley) and 3 Crew Health Care System racks.* • *For U.S. Lab, delivers 1 systems rack, 1 stowage rack and experiment racks.*

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Feb 2003 target date, flight details still under review	*1E*	*US Space Shuttle (STS-124)*		• *European Laboratory-Columbus Orbital Facility*	• *Delivers the European Space Agency's primary contribution to the station, the Columbus Orbital Facility laboratory, provides additional research capability.*
Mar 2003	18A	US Space Shuttle (STS-125)		• U.S. Crew Return Vehicle (CRV)	• Crew Return Vehicle attached to the station provides additional 7-person crew return capability added to already existing 3-person Soyuz crew return capability
June 2003	19A	US Space Shuttle (STS-127)		• Multi-Purpose Logistics Module	• Delivers 4 crew quarters racks to be placed in Node 2 and provide for transition to 6-person crew • Delivers 6 U.S. stowage racks • Delivers third starboard truss segment (S5 truss)
July 2003	15A	US Space Shuttle (STS-128)		• Solar Arrays and Batteries (Photovoltaic Module S6)	• Fourth and final set of U.S. solar arrays delivered along with fourth starboard truss segment (S6).
Sep 2003	UF-6	US Space Shuttle (STS-129)		• Multi-Purpose Logistics Module • Batteries	• Provides for experiment delivery, resupply and changeout. • Delivers two solar array batteries to complete station battery outfitting.
Nov 2003	UF7	US Space Shuttle (STS-130)		• Centrifuge Accomodations Module (CAM)	• The Centrifuge Accommodations Module (CAM) completes the complement of station laboratory facilities providing a facility to control gravity for research activities. The CAM attaches to Node 2.

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Jan 2004	16A	US Space Shuttle (STS-131)		• U.S. Habitation Module	• Delivers U.S. Habitation Module to enhance crew accomodations and provide for a station crew with as many as seven members.

NOTES:

- ***Additional Progress, Soyuz, possible H-II Transfer Vehicle and Automated Transfer Vehicle flights for crew transport, logistics and resupply are not listed.***